OCR
Oxford Cambridge and RSA

Thursday 25 May 2023 – Afternoon

Level 3 Certificate Core Maths A (MEI)

H868/02 Critical Maths

Time allowed: 2 hours

You must have:
- the Insert (inside this document)

You can use:
- a scientific or graphical calculator

Please write clearly in black ink. **Do not write in the barcodes.**

Centre number | | | | | | Candidate number | | | | |

First name(s) _____

Last name _____

INSTRUCTIONS
- Use black ink. You can use an HB pencil, but only for graphs and diagrams.
- Write your answer to each question in the space provided. If you need extra space use the lined pages at the end of this booklet. The question numbers must be clearly shown.
- Answer **all** the questions.
- Where appropriate, your answer should be supported with working.
- Give your final answers to a degree of accuracy that is appropriate to the context.

INFORMATION
- The total mark for this paper is **60**.
- The marks for each question are shown in brackets **[ ]**.
- This document has **20** pages.

ADVICE
- Read each question carefully before you start your answer.

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1 An air traffic control strike stopped flights into and out of a country for a week.
Because of the strike, four airlines have to refund all the customers who were intending to fly that week.
One month after the end of the strike, two newspapers published charts to show how the refunds are going. These are shown in **Fig. 1.1** and **Fig. 1.2**.

Fig. 1.1

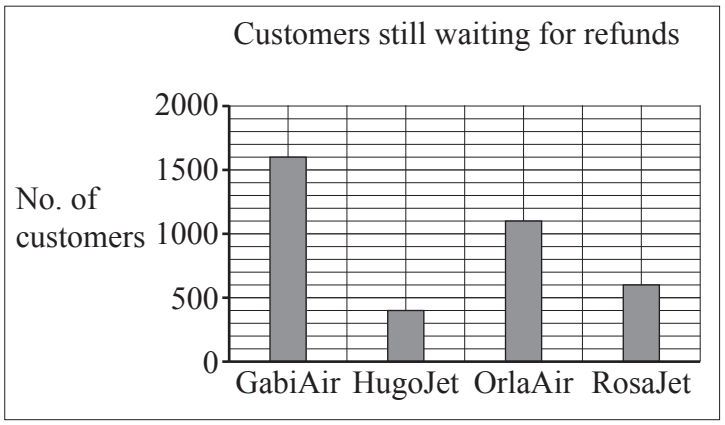
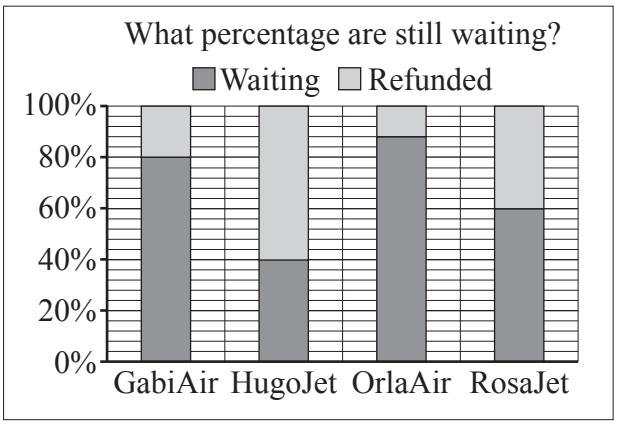


Fig. 1.2



Both charts have used the correct data.

(a) (i) How many GabiAir customers are still waiting for refunds? **[1]**

(ii) How many GabiAir customers have been refunded? **[2]**

(b) How many HugoJet customers have been refunded? **[2]**

1(a)(i)	
1(a)(ii)	
1(b)	

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(c) State whether the following statement is justified, explaining your reasoning.

"There are nearly twice as many customers waiting for refunds from OrlaAir as from RosaJet."

[1]

(d) State whether the following statement is justified, explaining your reasoning.

"If they don't speed up with the refunds, it will take GabiAir another 8 months to refund all their customers." **[2]**

1(c)	
1(d)	

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2 This question refers to article A in the pre-release material, "Cold Weather Payments". You can find the article on the insert accompanying this paper.

(a) (i) What was the **minimum** temperature recorded at Andrewsfield on 6 February 2021? **[1]**

(ii) What was the **maximum** temperature recorded at Andrewsfield on 6 February 2021? **[1]**

2(a)(i)	
2(a)(ii)	

(b) Some politicians are discussing changes to the rules.
Three possible rules are given below.

For each of the rules, decide whether it would result in a payment for the data shown in the insert and tick the appropriate box.
Explain your reasoning.

2(b)(i)	**Rule A:** The average temperature on each of the 7 consecutive days has to be below 0 °C.
	☐ Payment ☐ No payment ☐ Can't tell
	Reason

[2]

2(b)(ii)	**Rule B:** The mean of the temperatures at mid-day (12:00) over the 7 days has to be below 0 °C.
	☐ Payment ☐ No payment ☐ Can't tell
	Reason

[2]

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2(b)(iii)	**Rule C:** The temperature on each of the 7 consecutive days has to drop below 0 °C.
	☐ Payment ☐ No payment ☐ Can't tell
	Reason

[2]

(c) Alex is thinking about how the current rules for Cold Weather Payments work.
She says, *"If all the temperatures recorded at Andrewsfield from 6 to 12 February 2021 had been 0.5°C higher then it would not have been cold enough for a Cold Weather Payment."*

Determine whether Alex is right.
Show your reasoning. **[2]**

2(c)	

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3 This question refers to article B in the pre-release material, "Using a 100 square to represent percentages". You can find the article on the insert accompanying this paper.

A business offered the employees in head office free membership at a gym of their choice.

They monitored the percentage of employees who took up membership and the percentage of employees who had used their chosen gym in the past month.
Fig. 3.1 shows the percentages on 7 June.

On 15 June, the offer was extended to **all** employees of the company.
Fig. 3.2 shows the percentages on 5 July in the same year.

Fig. 3.1

7 June
Out of head office employees
71.3% members
40.6% users

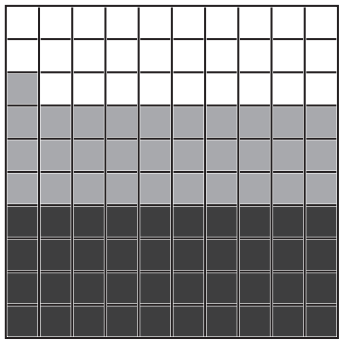
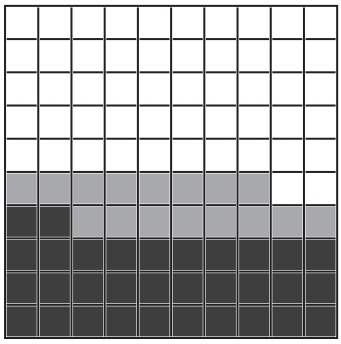


Fig. 3.2

5 July
Out of all employees
48.9% members
32.2% users



(a) Suggest **one** reason why the percentages are lower in **Fig. 3.2** than in **Fig. 3.1**. **[1]**

3(a)	

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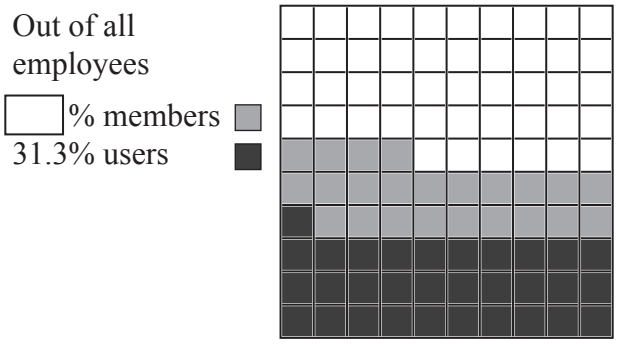
(b) **Fig. 3.3** shows the percentages at a later date.
One number is missing from the label.
The person who drew the chart was given the percentages to one decimal place.

In **Fig. 3.3**, give the smallest and largest possible value of the members' percentage.
Give your answers to **one** decimal place.

Fig. 3.3



[2]

3(b)	**Members' smallest value**
	Members' largest value

(c) From the start of August to the end of August, company sales fell by 42% due to holidays.
From the start of September to the end of September in the same year, sales rose by 45.5%.

Show that the overall change, from the start of August to the end of September, was a decrease and give the percentage decrease to **one** decimal place. **[4]**

3(c)	

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4 A local council is deciding what to do with 50 hectares of land.
A hectare is $10\,000\,m^2$.

(a) One councillor suggests planting trees on the land.
He says it would be possible to plant 20 million trees on the land.

Decide whether it is realistic to have 20 million trees on 50 hectares.
Show your reasoning. **[3]**

4(a)	

(b) Another local councillor says that young people find it difficult to buy a house in the area.
She suggests building affordable houses on the land.
Each house would be suitable for a small family.
There will be no blocks of flats, just individual houses.

Estimate how many houses could be built on 50 hectares. **[6]**

4(b)	
	(answer space continued on next page)

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4(b)	(continued)

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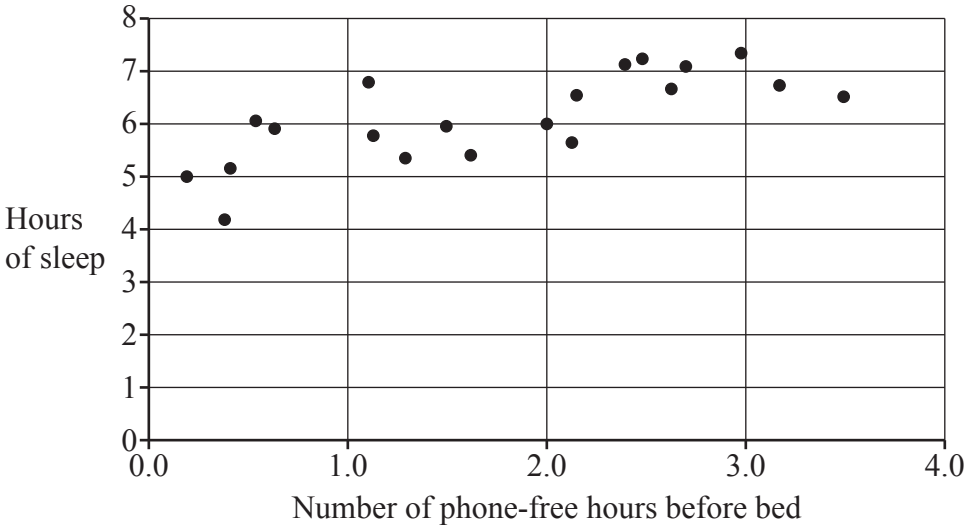
5 As a pilot project a researcher asks a group of 20 adults for two items of information about their sleep on one particular night:

- How many hours of sleep they had.
- When they last used their phones before going to bed.

The data are shown in **Fig. 5**.

Fig. 5



(a) Circle the point in **Fig. 5** that shows the data for the adult who got the least sleep. **[1]**

(b) What kind of correlation is shown in **Fig. 5**? Tick the correct box. **[1]**

(c) Give **one** reason why the data do **not** provide clear evidence that using your phone close to bed-time reduces the amount of sleep. **[1]**

5(b)	☐ Positive correlation ☐ Negative correlation ☐ No correlation
5(c)	

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To investigate this situation further, the researcher recruits 400 people for a randomised controlled trial.

Group A will **not** be allowed to use their phones in the three hours before going to bed.
Group B will be asked to use their phones in the three hours before going to bed.

Phone use and hours of sleep will be recorded automatically for each person.

(d) Briefly describe **one** method of allocating the 400 people to the two groups at random. **[1]**

(e) Why is it important to allocate the people to the groups at random? **[1]**

(f) Why is it **not** possible for this to be a blinded trial? **[1]**

(g) Give **one** advantage of recording phone use and hours of sleep automatically. **[1]**

5(d)	
5(e)	
5(f)	
5(g)	

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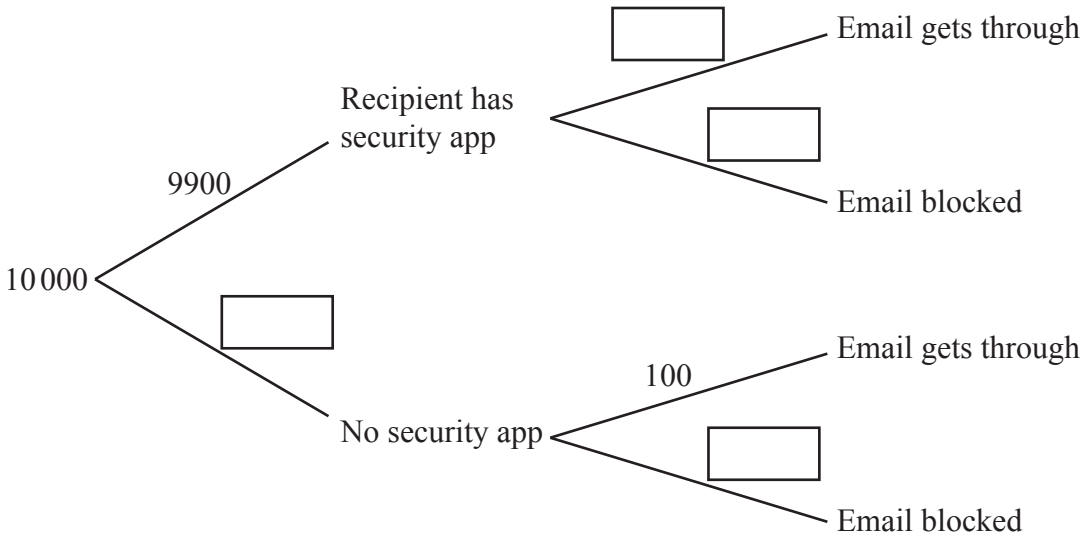
6 Scam emails are designed to fool the people receiving them into giving money to the sender. A security app provides protection against them.

Assume:

- If installed, the security app blocks 98% of scam emails.
- 99% of scam emails go to people who have the security app installed.
- Without the security app, all scam emails get through.

(a) Based on the information above, complete the tree diagram to show outcomes for a representative 10 000 scam emails sent. **[3]**

6(a)



(b) What proportion of scam emails get through? **[2]**

(c) A scam email gets through.
What is the probability that the recipient has the security app? **[2]**

6(b)

6(c)

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A news report makes the following claim.

Most people who get scam emails already have security apps installed

(d) Using the data in this question, comment on whether the claim is likely to be true. **[1]**

(e) Using the data in this question, comment on whether it is worth having the security app installed. **[1]**

6(d)	
6(e)	

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7 A psychologist investigated whether background music affects people's ability to learn.

- The psychologist asked volunteers to memorise a list of 20 words without background music and a different list of 20 words with background music.
- The volunteers were tested to see how many words they remembered.
- Some of the volunteers memorised the list without background music first and others memorised the list with background music first.

(a) Give **one** reason why it is a good idea to ask some people to memorise with background music first and others to memorise without background music first. **[1]**

7(a)	

(b) The psychologist conducted the investigation with a small sample of 8 people to check that it worked.
The table shows the number of words each person got correct.

Person	**A**	**B**	**C**	**D**	**E**	**F**	**G**	**H**
Without music	6	5	16	9	7	6	8	14
With music	12	5	17	8	11	7	8	12

People who did equally well on both lists were **not** included in the psychologist's analysis of the data.

(i) How many people **were** included in the analysis? **[1]**

(ii) How many people did better with background music? **[1]**

(iii) Does your answer to part **(b)(ii)** prove that people learn better with background music? Give **one** reason to justify your answer. **[1]**

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7(b)(i)	
7(b)(ii)	
7(b)(iii)	

Turn over for question 7(c)

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(c) The psychologist then conducts the investigation with a larger number of people.
196 people are included in the analysis.

Assume that background music makes no difference.
Imagine lots of random samples of 196 people are taken and the number of people who did better with background music is counted in each sample.

(i) What will be the mean number of people who did better with background music in the samples? **[1]**

(ii) What will be the standard deviation of people who did better with background music in the samples? **[2]**

The psychologist will conclude that background music makes **no** difference if the number of people who did better with music is less than three standard deviations away from the mean.

(iii) How many people doing better with background music will lead the psychologist to conclude that music makes **no** difference? **[3]**

7(c)(i)	
7(c)(ii)	
7(c)(iii)	

END OF QUESTION PAPER

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ADDITIONAL ANSWER SPACE

If additional space is required, you should use the following lined page(s). The question number(s) must be clearly shown in the margin(s).

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